



Master's Thesis

Multi-Channel Anypath Routing for Multi-Channel Wireless Mesh Networks

Andreas Lavén
a.laven@gmail.com

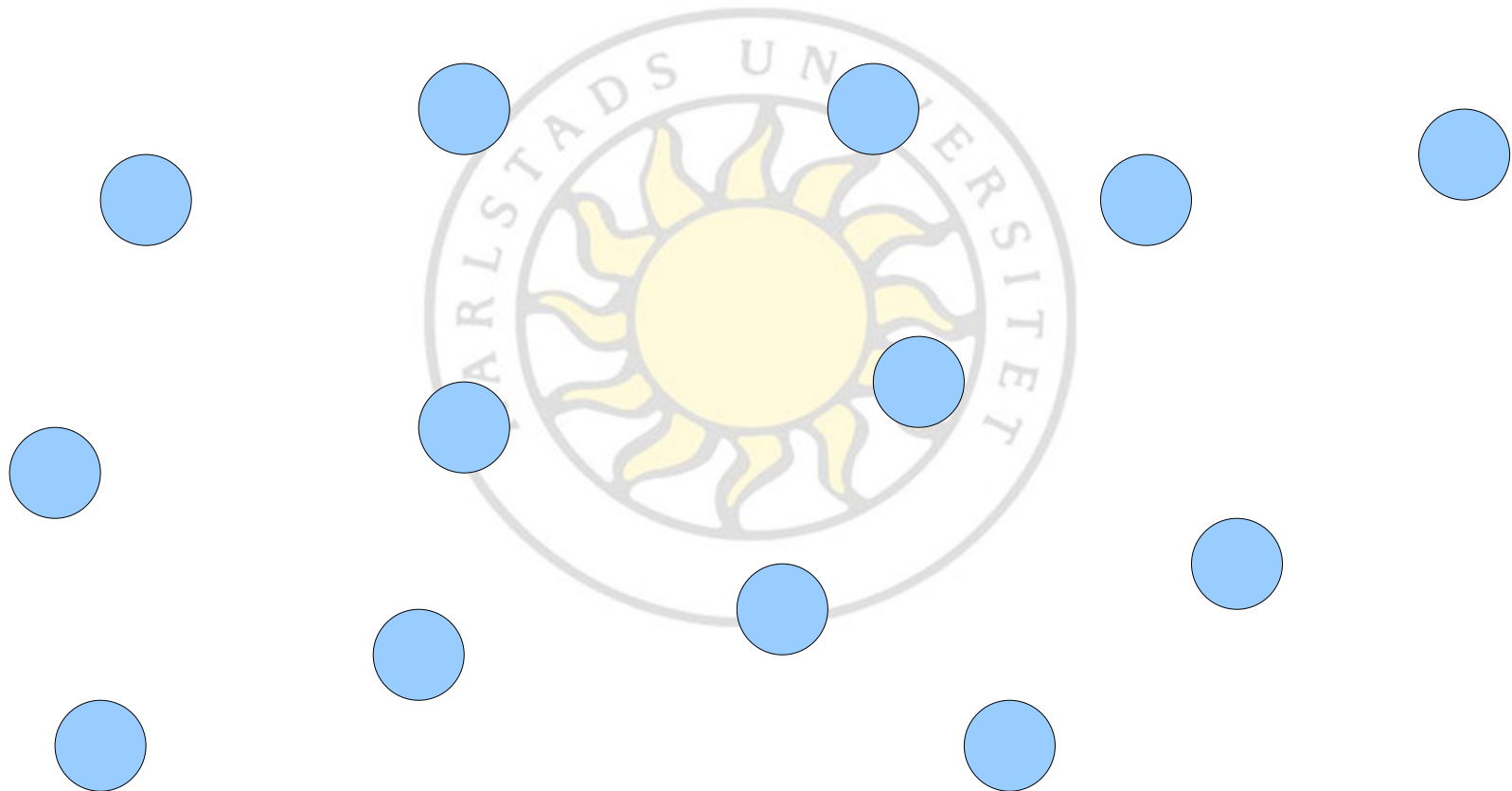


Table of Contents

- Background
- Goals and Conclusions
- Routing
- Anypath Paradigm
- Test
- Loop Issue
- Further Research



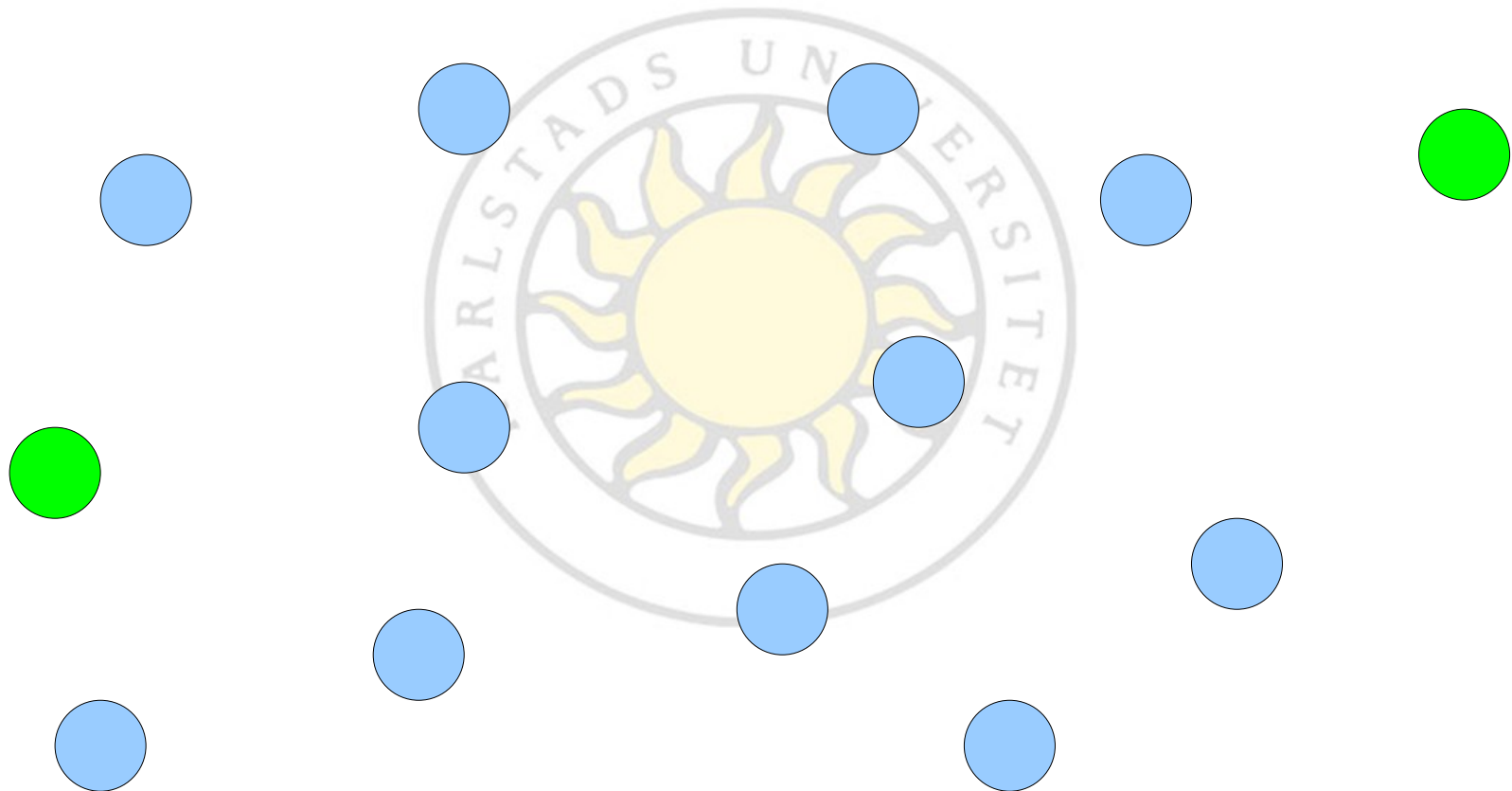
Wireless Mesh Network



Multi-Channel Anypath Routing for
Multi-Channel Wireless Mesh Networks



Wireless Mesh Network



Multi-Channel Anypath Routing for
Multi-Channel Wireless Mesh Networks

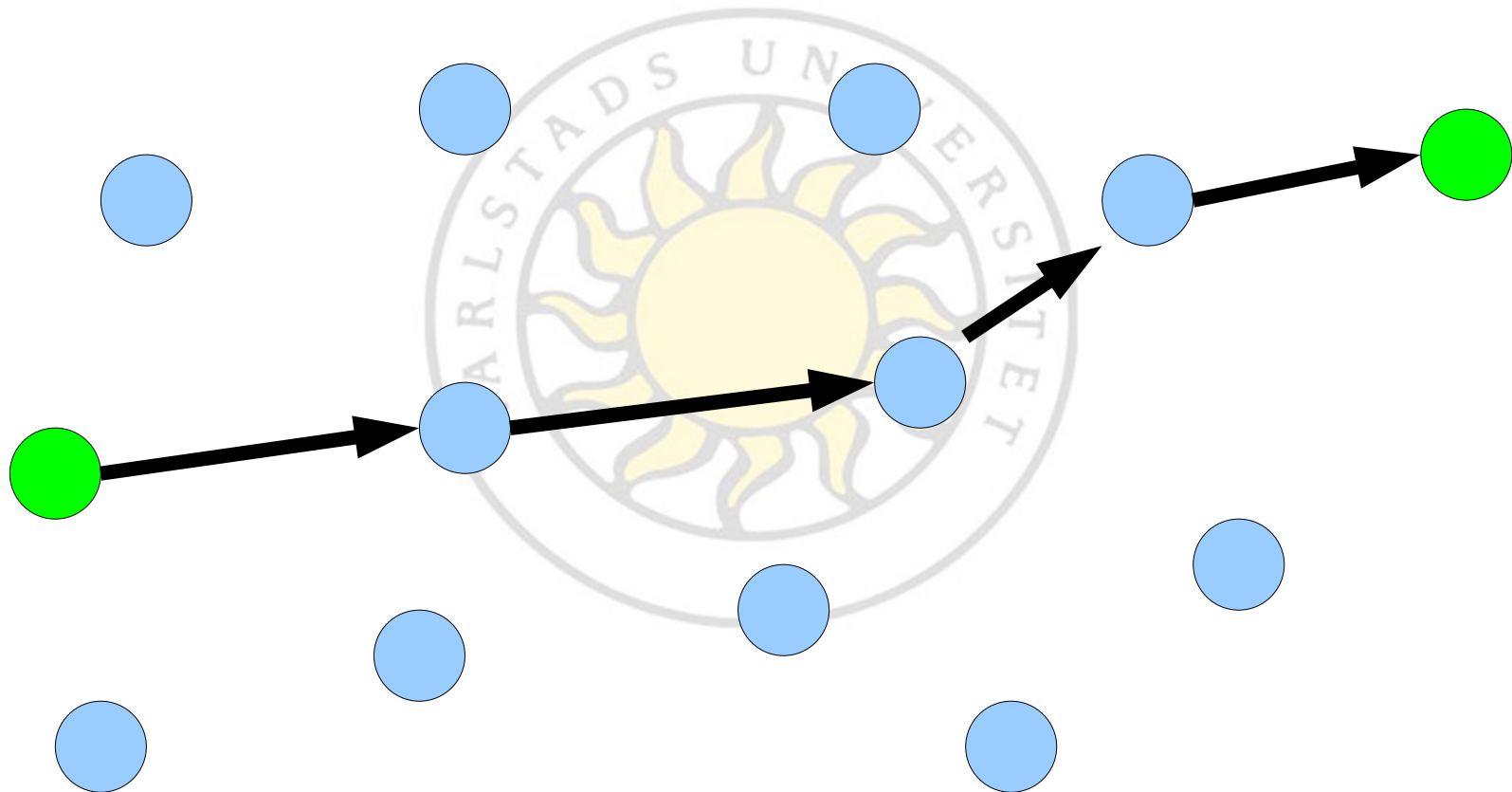


Finding the Best Path

- Algorithm
 - Shortest path first
- Metrics
 - Hop Count Metric
 - Better suited for wired networks
 - Does not considers quality of links
 - Expected Transmission Count (ETX)
 - Expected Transmission Time (**ETT**)



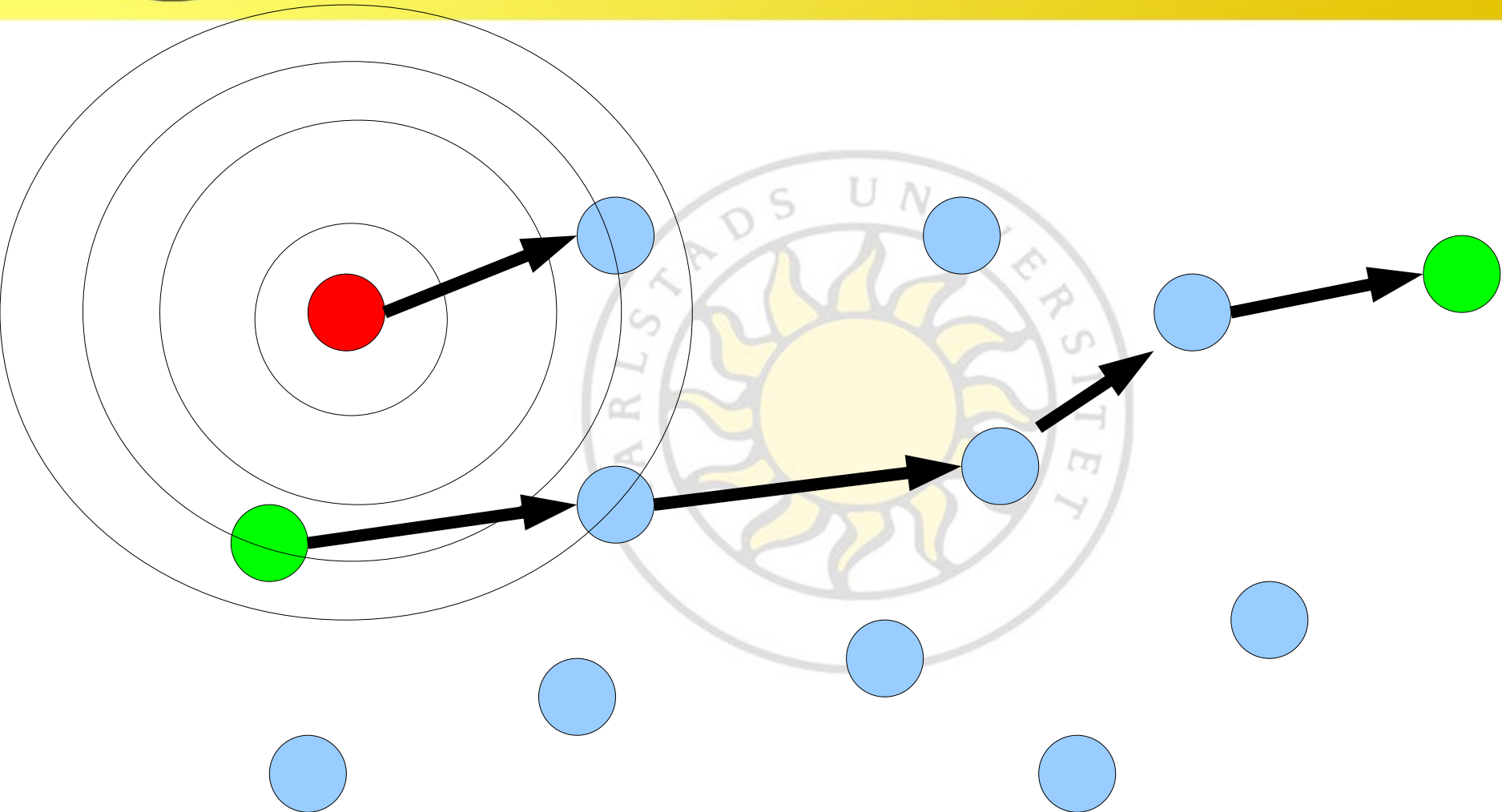
Wireless Mesh Network



Multi-Channel Anypath Routing for
Multi-Channel Wireless Mesh Networks



Interference



Multi-Channel Anypath Routing for
Multi-Channel Wireless Mesh Networks

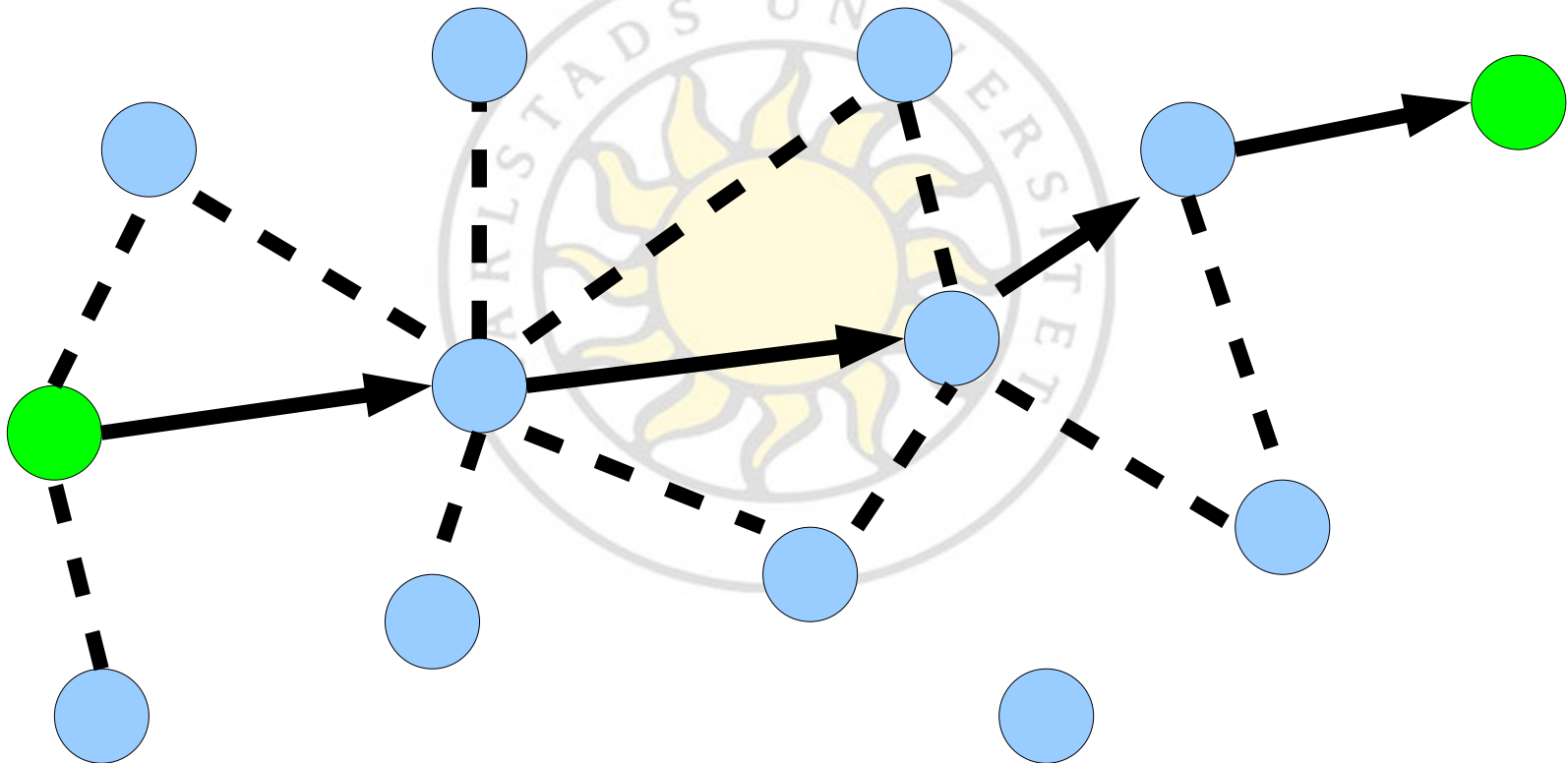


Channel Diversity

- Sending information to different nodes on different channels
- Net-X
 - **Fixed** channel on receiving interface
 - **Switchable** channel on sending interface
- ChaCha
 - **Determines a channel** for the receiving interface
 - **Distributes** the information



Channel Switching



Multi-Channel Anypath Routing for
Multi-Channel Wireless Mesh Networks



Thesis Project

- Goal
 - **Develop** and **evaluate** a routing mechanism following the **anypath paradigm**
- Conclusions
 - The anypath paradigm can **decrease** the **transmission delay**

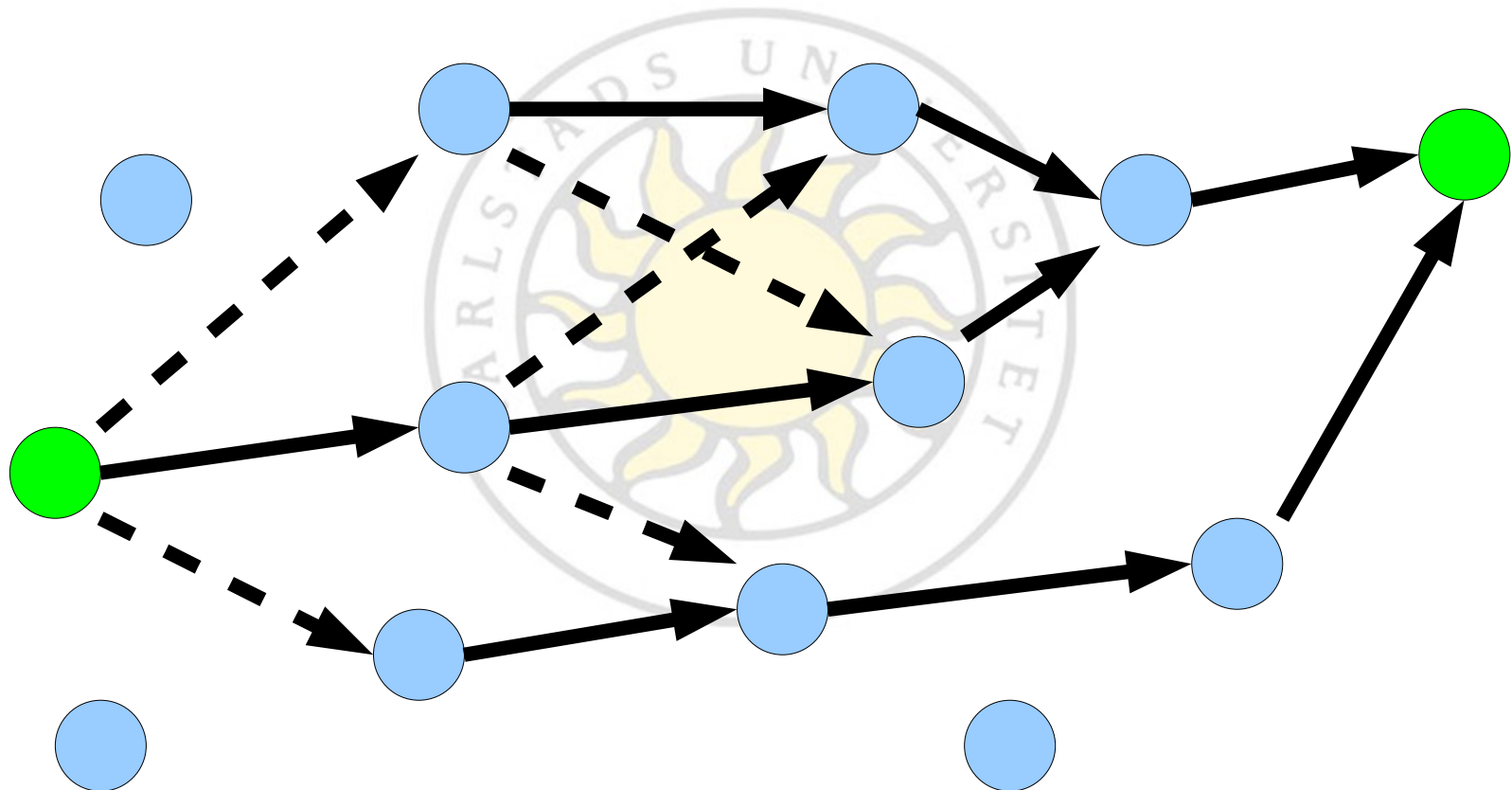


Requirements of Anypath

- Routing algorithm finds **multiple next hops**
 - All using different channel
- Extension of routing table
- **Next hop selection**



Anypath



Multi-Channel Anypath Routing for
Multi-Channel Wireless Mesh Networks



Routing Metrics

- Routing algorithm routes on **time**
 - Next hop selection
- Links
 - Expected Transmission Time (**ETT**)
- Nodes
 - Switching Cost Metric (**SC**)



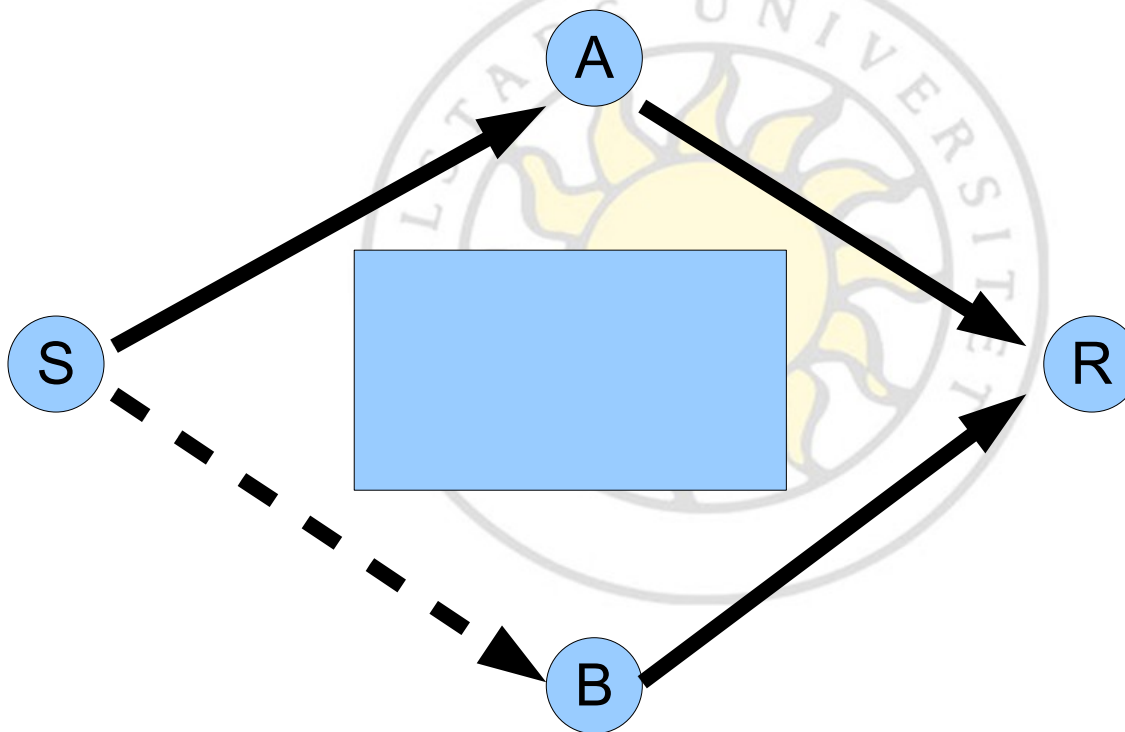
Next Hop Selection

- Loop through all possible next hops
- Compare delays
 - Switch delay on current node +
 - Path cost (time)
- Select the next hop with lowest total cost



Test

- Sending packet from S to R



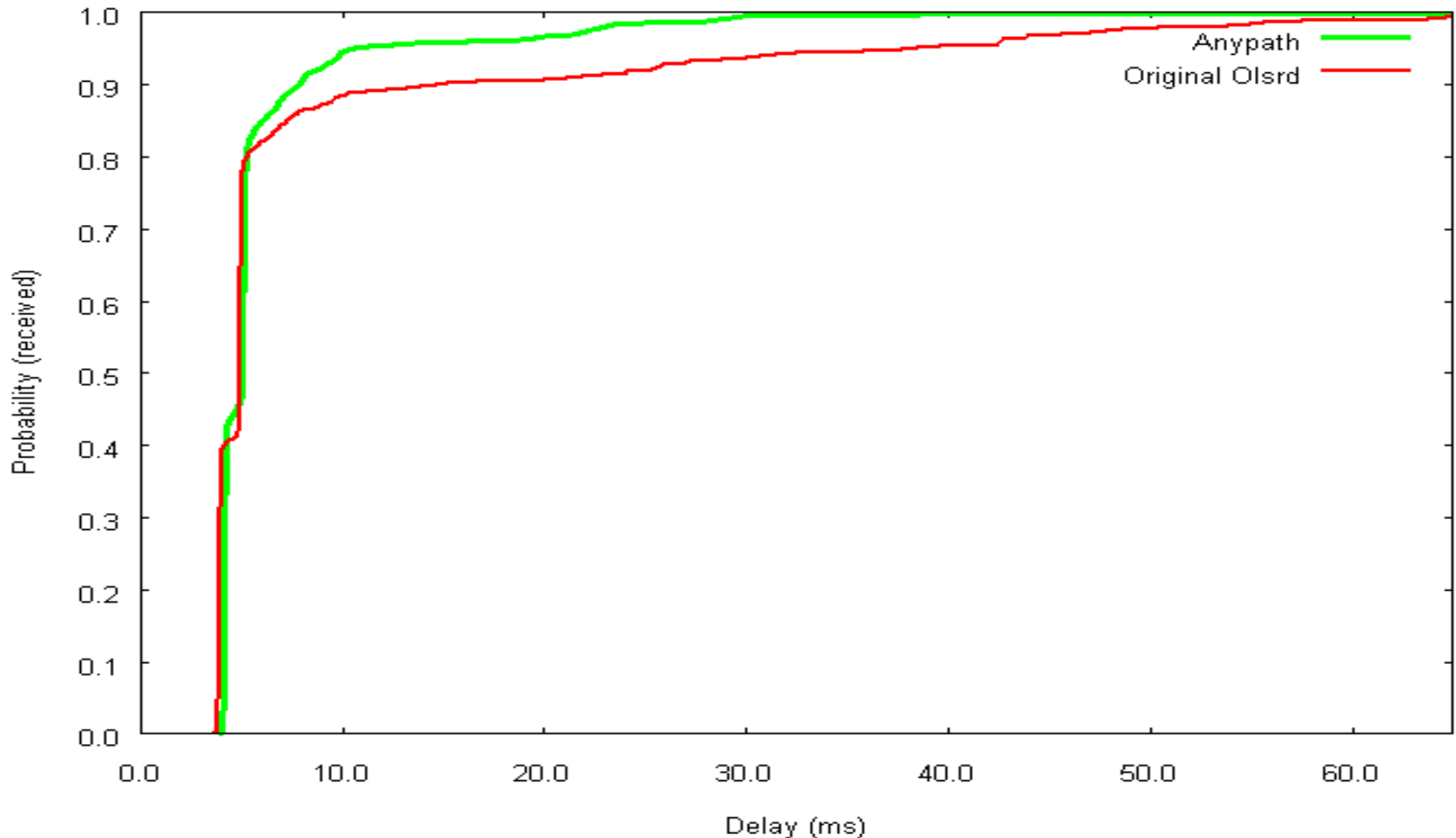


Test Result

- Average delay
 - Single path: 8.2 ms
 - **Anypath: 6.4 ms**
- Probability of received after 23 ms
 - Single path: 91 %
 - **Anypath: 99 %**



Probability of Received



Multi-Channel Anypath Routing for
Multi-Channel Wireless Mesh Networks



Loop Issue

- Issue
 - A packet **circulates** within the network without making any progress toward its destination
- Solution
 - A value of **maximum allowed number of hops** is set by creator of each packets



Further Research

- Tests in larger networks (i. e. containing more nodes)
 - Loop prevention
 - Re-ordering
- Routing algorithm suited for anypath forwarding
 - Different paths are affected differently by the anypath paradigm



Thank you



Questions?

Multi-Channel Anypath Routing for
Multi-Channel Wireless Mesh Networks